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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/826,153	04/16/2004	Erik C. Scher	01-002001	8584

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EXAMINER	
NEGIN, RUSSELL SCOTT	
ART UNIT	PAPER NUMBER
1631	

NOTIFICATION DATE	DELIVERY MODE
01/25/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patents@nanosysinc.com

Office Action Summary	Application No.	Applicant(s)	
	10/826,153	SCHER ET AL.	
	Examiner	Art Unit	
	RUSSELL S. NEGIN	1631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 November 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *26-37,40-42,44,45,47,48 and 60-69* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *26-37,40-42,44,45,47,48 and 60-69* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11 November 2009 has been entered.

Comments

Claims 26-37, 40-42, 44-45, 47-48, and 60-69 are pending and examined in this Office action.

Withdrawn Rejections

ALL of the prior art rejections from the previous Office action are withdrawn in view of amendments filed to the instant set of claims on 11 November 2009. ALL of the rejections in the instant Office action are NEWLY APPLIED.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

35 U.S.C. 103 Rejection #1:

Claims 26-37, 41-42, 44-45, 47-48, and 60-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Han et al. [Nature Biotechnology, July 2001, volume 19, pages 631-635] in view of Kagan et al. [Physical Review Letters, 1996, volume 76, pages 1517-1520] in view of Takagahara [Surface Science, 1992, volume 267, pages 310-314].

Claim 26 is drawn to a composition for tagging objects comprising a population of nanocrystals comprising two or more subsets of nanocrystals, the population characterized by a unique spectral code. The composition also requires that each subset comprises a plurality of quantum dots of the same size and/or composition. The composition also comprises that the unique spectral code of the population comprises

at least one optical property defined by the interaction of optical properties of at least two of the two or more subsets of nanocrystals, wherein the interaction is other that the excitation wavelength of a first nanocrystal subset exciting a second nanocrystal subset.

The article of Han et al. studies quantum-dot (nanocrystal) tagged microbeads for multiplexed optical coding of biomolecules.

The principles of the instantly rejected claims are most clearly illustrated in Figure 5 on page 634 of Han et al. The top schematic of the figure illustrates a composition comprising a composition of quantum dot nanocrystals (they are illustrated as little circles in the larger microbead). This composition emits light when excited (specifically with a UV lamp as taught in the "Multicolor imaging" section of "Experimental Protocol" on page 635 of Han et al.) resulting in the encoding of a unique optical spectral code (i.e. 1:1:1) for the composition as illustrated in the upper right of Figure 5 of Han et al. Then, the bottom three schematics of Figure 5 of Han et al., illustrates each of the three respective probes tagged with the compositions comprising additional subsets of nanocrystals. Each of these three compositions is then excited with the UV lamp to produce respective optical or unique spectral codes. It is noted that all of the nanocrystals in each of the subsets are each of the same composition (CdSe quantum dots- Figure 1 of Han et al.) Han et al. alters the size and amount of nanocrystals within each microbead to result in a different color emission [see paragraph bridging columns 1 and 2 on page 631 and Figures 1 and 3 of Han et al.] Consequently, each subset of CdSe quantum dots emitting at a specific wavelength has the same size and concentration distributions within the microbeads; subsets of CdSe quantum dots

emitting at different wavelengths have different size and concentration distributions within the microbeads.

Han et al. does not show any interactions between the optical properties of the plurality of sets of nanoparticles.

The article of Kagan et al. describes electron energy transfer (i.e. an interaction wherein the emissions or optical property of one nanocrystal excites a second nanocrystal) in CdSe quantum dots. Specifically, the last sentence of the first paragraph on page 1517 of Kagan et al. states:

> Optical nonlinearity should be further enhanced in a QD [quantum dot] array as coupling of electronic excitations between dots expands the exciton coherence length, enabling it to collect oscillator strength from dots within that larger volume [Reference 8].

Consequently, coupling quantum dots as in Kagan et al. has advantages resulting the cooperative interactions to improve quantum mechanical properties of the system. For example, “Reference 8” of the above cited passage from Kagan et al. refers to Takagahara (the fourth reference in this rejection), which describes the “merits," results, and properties of the quantum dots that are changed (such as the exciton coherence length; and nonlinearity of emissions) as a result of interactions between the particles.

With regard to claim 27, the nanocrystals of Han et al. comprise CdSe nanocrystals.

With regard to claims 28-29, while Han et al. does not explicitly equate a diameter for the CdSe nanocrystals, Han et al. does give an example in the first full paragraph of column 2 on page 632 that a 1.2 micron bead that houses 50,000 CdSe nanocrystals has about 0.1% vol/vol of the bead as nanocrystal. Using this data, the diameter of the CdSe is back-calculated to be about 15.2 nm, which meets the limitations recited in these two claims.

With regard to claim 30, the CdSe nanocrystals are linked to polystyrene beads with the assistance of acrylic acid [see first paragraph of experimental protocol on page 635 of Han et al.]

With regard to claims 31-33, Figure 1 of Han et al. illustrates spectra of ZnS capped CdSe nanocrystals.

With regard to claim 34, Figure 5 of Han et al. illustrates emission spectra corresponding to a plurality of subsets of nanocrystals that comprise spectra that have different light emission wavelengths.

With regard to claim 35, the last sentence of the paragraph bridging columns 1-2 on page 631 of Han et al. teach that the quantum dots used have symmetrical emission peaks that are 25-30 nm full width at half maximum.

With regard to claim 36, the emulsion of styrene to which the nanocrystals are added (and to which the tagged beads are synthesized- see page 635 of Han et al.) is interpreted to involves steps of colloidal synthesis.

With regard to claim 37, the emissions in Figure 6 of Han et al. are all in the visible range.

With regard to claims 41-42, Figure 3A of Han et al. illustrates predetermined emissions at wavelengths as a function of nanocrystal concentration in each of the plurality of beads.

With regard to claims 44-45, microbeads with the concentration illustrated in the top microbead in Figure 5 have the predetermined spectral code; Figure 5 also illustrates that changing the concentrations of the nanocrystals in the beads changes the spectral codes.

With regard to claims 47-48, the barrier for nanocrystals described on page 635 of Han et al. is the thermoplastic polystyrene.

With regard to claims 60 and 62-63, polystyrene is the affinity molecule, polymer, and adherent matrix in which the nanocrystals are attached or disposed [see page 635 of Han et al.]

With regard to claim 61, polystyrene beads are the objects tagged with the nanocrystal compositions [see page 635 of Han et al.]

With regard to claim 64-66, the cooperative interactions between the nanocrystals are discussed in terms of the electron energy transfer explained in the cited portions Kagan et al. and Takagahara. These electron energy comprise types of light that have wavelengths, frequencies, and intensities.

Claim 67 is drawn to a composition used for tagging and detecting solid material objects other than molecules, biomolecules, chemical elements, and chemical compounds, comprising a population of nanocrystals comprising two or more subsets of nanocrystals that emit light when excited, wherein the population has a unique spectral code. This spectral code comprises the excitation and emission spectra of the

population upon excitation with one or more select excitation wavelengths. Claim 68 further limits the objects of claim 68.

It is noted that for the purpose of examination, since the composition (i.e. product) comprising nanocrystals COULD be used for "*tagging and detecting solid material objects other than molecules, biomolecules, chemical elements, and chemical compounds*," [as recited in claim 67], the instant combination of prior art meets the requirement of showing this intended use of this product. [See MPEP 2113].

As discussed above, Han et al. teaches multiple nanocrystal subsets that emit light when excited to display unique spectral codes [see Figure 5 of Han et al.] However, Han et al. teaches only spectral codes in terms of emissions and not excitation spectra.

As discussed above, the article of Kagan et al. describes electron energy transfer (i.e. an interaction wherein the emissions or optical property of one nanocrystal excites a second nanocrystal) in CdSe quantum dots. Consequently, in teaching cooperativity of the nanocrystals, Kagan et al. also teaches that the unique emissions spectra of Han et al. also result in unique excitation spectra.

It would have been obvious to someone of ordinary skill in the art at the time of the instant invention to modify the optical properties of Han et al. by use of interacting sets of quantum dots as in Kagan et al. and Takagahara wherein the motivation would have been that interaction between quantum dots often result in beneficial cooperative effects that enhance the optical and quantum properties of the set of quantum dots [see

first paragraph of the introduction of Kagan et al. which is elaborated in the last paragraph of Takagahara].

Response to Arguments:

Applicant's arguments with respect to the instant claims have been considered but are moot in view of the new ground(s) of rejection.

35 U.S.C. 103 Rejection #2:

Claim 69 is rejected under 35 U.S.C. 103(a) as being unpatentable over Han et al. as applied to claims 26-37, 41-42, 44-45, 47-48, and 60-66 above, in view of Chen et al. [Physical Review B, volume 64, 2001, pages 245304-1 to 245304-4].

Claim 69 is drawn to a composition for tagging and detecting objects comprising a population of nanocrystals comprising two or more subsets of nanocrystals, the population comprising a unique spectral code. The composition also requires that the unique spectral code comprises one or more predetermined excitation wavelengths and a corresponding emission profile for the population of nanocrystals. The composition also requires that the unique spectral code further comprises

Han et al. shows a composition resulting in a unique nanocrystal spectral code, as discussed above.

Han et al. does not explicitly analyze the nanocrystal composition using polarization angles.

The article of Chen et al. studies polarization spectroscopy of CdSe.

Specifically, Chen et al. investigate the roles excitation and emission polarization angles in optical properties in Figures 4-5 on page 245304-3 of Chen et al.

It would have been obvious to someone of ordinary skill in the art at the time of the instant invention to modify the excitation of the nanocrystals of Han et al. by use of the excitation and emissions polarization angles Chen et al. because it is obvious to substitute known elements in the prior art to yield a predictable result. In this instance, measuring by angle is an alternate form of assessing optical properties than measurement by wavelength or distance.

There would have been a reasonable expectation of success in combining Han et al. and Chen et al. because all studies pertain to use of excitation wavelengths (that must be inflicted at an angle) to produce emissions spectra in CdSe nanocrystals.

Response to Arguments:

Applicant's arguments with respect to the instantly rejected claims have been considered but are moot in view of the new ground(s) of rejection.

35 U.S.C. 103 Rejection #3:

Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Han et al. in view of Kagan et al. in view of Takagahara as applied to claims 26-37, 41-42, 44-45, 47-48, and 60-66 above, in view of Bruchez et al. [US Patent 6,274,323 B1; issued 14 August 2001; filed 5 May 2000].

Claim 40 is further limiting wherein the unique spectral code for the nanocrystals comprises emissions spectra in the non-visible wavelengths.

Han et al., Kagan et al., and Takagahara make obvious a composition resulting in a unqiue nanocrystal spectral code, as discussed above.

Han et al., Kagan et al., and Takagahara do not teach non-visible emissions profiles.

The patent of Bruchez et al. uses semiconductor nanocrystals as detectable labels in various chemical and biological species.

Bruchez et al. comprises semiconductor nanocrystals producing emissions in the nonvisible spectra in column 17, lines 30-32 and column 20, lines 28-33, which states, respectively:

> Finally, semiconductor nanocrystals that emit energy in the blue to near ultraviolet include, but are not limited to ZnS and GaN.
>
> Likewise, for semiconductor nanocrystals producing emissions in the infrared or ultraviolet regions, the characteristic wavelengths that the discrete optical transitions occur at provide information about the identity of the particular semiconductor nanocrystal, and hence about the identity of or location of the analyte of interest.

Consequently, the nanocrystals of Bruchez et al. comprise nanocrystal populations with nonvisible emissions spectra.

It would have been obvious to someone of ordinary skill in the art at the time of the instant invention to modify the nanocrystals emissions spectra in the visible wavelengths of Han et al., Kagan et al., and Takagahara to UV (i.e. nonvisible) emissions spectra in Bruchez et al. because it is obvious to substitute known elements in the prior art to yield a predictable result. In this instance, nonvisible emissions of

Bruchez et al, profiles are an alternate form of emissions than the visible emissions spectra of Han et al. There would have been a reasonable expectation of success in combining Han et al., Kagan et al., Takagahara, and Bruchez et al. because they all are capable to pertain to emissions spectra of CdSe nanocrystals.

Conclusion

No claim is allowed.

Papers related to this application may be submitted to Technical Center 1600 by facsimile transmission. Papers should be faxed to Technical Center 1600 via the central PTO Fax Center. The faxing of such pages must conform with the notices published in the Official Gazette, 1096 OG 30 (November 15, 1988), 1156 OG 61 (November 16, 1993), and 1157 OG 94 (December 28, 1993)(See 37 CFR § 1.6(d)). The Central PTO Fax Center Number is (571) 273-8300.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Russell Negin, whose telephone number is (571) 272-1083. The examiner can normally be reached on Monday-Friday from 8:30 am to 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's Supervisor, Marjorie Moran, Supervisory Patent Examiner, can be reached at (571) 272-0720.

Information regarding the status of the application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information on the PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Russell S. Negin/
Examiner, AU 1631
13 January 2010